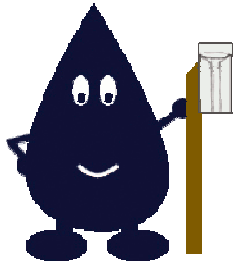


# Community Collaborative Rain, Hail and Snow School Network

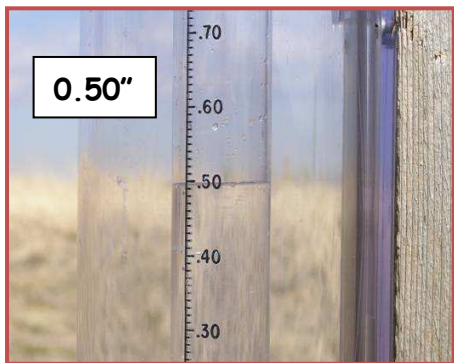
## Equipment and Measurements - Lesson 1



- Subjects: Climate and Weather
- Length of Activity: 60 minutes
- Objective: Demonstrate how to properly use a rain gauge and snow board to take accurate precipitation measurements
- Overview: Through hands-on exercises, students will learn how to properly read a rain gauge and measure the precipitation in it. Students will also learn about a snow board and how to take accurate snowfall and snow depth measurements using a yard stick.
- Preparation:
  - Teachers should complete a basic training course in observing and reporting precipitation. This short training can be completed online at <http://www.cocorahs.org> or with a CoCoRaHS instructor.
  - Students should be able to read and write measurements to hundredths of an inch, tenths of an inch, and in whole numbers.
  - A snow board will need to be purchased or can easily be made from an approximate 2ft x 2ft piece of plywood, then painted white.
- Materials and Supplies for this activity:
  - Official CoCoRaHS rain gauge
  - Snow Board
  - Yard Stick
  - Ruler
  - Container of water and sponge
  - Package of cotton balls
  - Small fan
  - 10 to 20 Pennies, 5 to 10 dimes and a dollar bill

➤ Demonstration/Teaching Activities:

- Begin by showing the students the rain gauge, snow board, and yard stick. Discuss what each is used for. Pass the equipment around so each student can see them close up and ask any questions.
- Make sure the students understand how to measure and read the markings on the rain gauge (to nearest hundredth), and measure and read snowfall on the snow board using the yard stick (to nearest tenth of an inch). To help demonstrate and teach this concept, use the pennies, dimes and dollar bill to represent hundredths, tenths and whole numbers on the gauge and yard stick. Randomly divide and count the money, using 5 pennies at first to



represent 0.05 inches of rainfall. Point to the 0.05 line on the rain gauge to connect the two principles. Next, add a dime and five more pennies to the original five pennies. Now point to the 0.20 inch line and explain tenths. Demonstrate this as many times as you feel necessary to help explain the concept.



- Demonstrate how to actually measure liquid in the rain gauge. The CoCoRaHS rain gauge is designed to hold a total of 11 inches of water, one inch in the INNER tube and 10 additional inches in the larger 'overflow' OUTER cylinder. Explain that rain gauges are usually designed with the collecting part at the top, funneling down to an inner tube inside the gauge. This way, we can easily record measurements in 1/100 inch increments. Demonstrate this by taking the funnel and inner tube out of the gauge. Next, fill the OUTER tube with water up to approximately 1 inch (hold a ruler next to the gauge to determine 1 inch, or estimate). Explain to the students that it just rained...about an inch. Ask the students if this is exactly one inch? How do they know? The increments are so small, it could be more or it could be less.
  - Next, pour this water directly into the INNER tube, filling it to the top. Notice the increments on the inner tube. One inch is labeled



at the top, with 1/100<sup>th</sup> markings up the side. Was it exactly 1 inch? You may find out that it is 0.98" or it may have passed the 1 inch line.

- This is why the inner tube is used. This allows us to accurately measure smaller, more common amounts of rain. If we had to measure directly, we could never measure rainfall like 0.05 inches.
- To further show this, take .05 from the INNER tube and pour it back into the OUTER tube. Can you accurately measure .05 this way with the ruler?

- Demonstrate how to measure snowfall on a snowboard. Spread the cotton balls out on top of the snow board to simulate snow that has fallen and needs to be measured. Using the yard stick, take approximately 5 to 10 different measurements across the board. Average these measurements to come up with a single, representative number for the snowfall on the board. Ideally, you may want to pile the cotton balls up on one side while leaving just a single layer on the other side to get different measurements. This simulates true snowfall as it will often vary across the board.



- Next, place a small fan several feet from the snow board and turn it on low. Allow the air to move the cotton balls around. Some may fall off the board and this is fine. Now take 5 to 10 measurements again, and take an average. Are the numbers the same? Discuss how wind can effect snowfall measurements. This is why snow can be difficult to measure and observations vary from one nearby location to the next. What happens if part of your snow board does not have snow on it? Include a measurement of 0 in your average.



#### ➤ Hands-on Activities and Fun:

- Break the students into 3 groups. Allow group 1 to experiment with the rain gauge, pouring different amounts in the INNER tube. Practice reading the measurements. This may be a good time to point out the meniscus that forms in the inner cylinder due to surface tension of the water on the sides of the curved gauge. Students should make their measurement from the bottom of the meniscus.

- How would you measure a rain event over one inch? Put the rain gauge back together. Pour water into the gauge, allowing it to overflow into the OUTER cylinder so an inch or two of water fills it. Remove funnel from top of gauge. Water in the INNER tube should read 1 inch. Note this and dump/discard water. Using the rain gauge top as a funnel, slowly pour water from OUTER cylinder into INNER tube until it reaches 1 inch or some lower value. Add this amount to the first 1 inch measurement. Complete this process until all water is gone from OUTER cylinder. Add measurements together for total rainfall.



- Allow Group 2 to experiment with the snow board, cotton balls and fan. Students should follow the same steps and procedures outlined previously, performing this task several times.
- Group 3 should be given the pennies, dimes and dollar bill. Students should practice dividing the money and determining what the measurement would be if this were actual rainfall.
- After about 10 minutes, have the groups rotate workstations so everyone can experience each experiment.

## Teacher Assessment:

Could students properly identify a rain gauge and snow board and explain the purpose of each?

Were students able to correctly read measurements in hundredths, tenths and whole numbers?

Do students understand the purpose of the smaller, inner tube and why it is necessary?

Can students take a rainfall measurement if there is more than 1 inch of precipitation in the rain gauge?

Did students understand what a meniscus was and how to use this feature when taking a measurement?

## **National Science Education Standards:**

NSES 5-8:

- Science as Inquiry (8ASI)

  - Abilities necessary to do scientific inquiry (8ASI 1)

  - Understandings about scientific inquiry (8ASI 2)

- Earth and Space Science (8DESS)

  - Structure of the earth system (8DESS 1)

## **Indiana Science Education Standards:**

ISES 5<sup>th</sup> and 6<sup>th</sup> Grade:

- The Nature of Science

- Scientific Thinking

- The Physical Setting

- The Mathematical World

- Common Themes

## **Sources:**

<http://www.cocorahs.org>